AN ANNOTATED LIST OF AUSTRALIAN LEECHES

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Synopsis

Some 45 " species " are listed with a brief description of essential characters and critical comment so far as possible. The species are distributed in 5 families (Piscicolidae, 19 ; Glossiphonidae, 9 ; Erpobdellidae, 3 ; Hirudidae, 9 ; Haemadipsidae, 5) and 21 genera. Since less than half are adequately described, keys cannot yet be constructed, but the list is a first and essential step to the further study of the leech fauna of Australia.

Introduction

The leeches of Australia have not previously been assembled or surveyed as a group. Ingram (1957) gives the only account of a regional fauna. Otherwise, the literature is scattered, widely varied in nature and often difficult to assess or interpret accurately. Not half of the recorded species are described in such manner as to permit them to be recognised again, other than in material from the original locality. Accordingly, reliable keys cannot be constructed at this time, nor for a matter of some years as, even at this point, at least 10 undescribed species are known to exist, additional to the following list. The list provides condensed essential descriptions and critical comment, so far as possible, for some 45 " species " in 5 families (Piscicolidae, 19 spp.; Glossiphonidae, 9 spp.; Erpobdellidae, 3 spp.; Hirudidae, 9 spp.; Haemadipsidae, 5 spp.) and contained in 21 genera of which 5 genera were based on Australian species.

The purpose of the list is to enable others to reach at least a provisional identification of any material coming to hand, to assist their entry to the literature more readily than is at present possible and, in this way, to encourage further studies on our leech fauna which is relatively rich, varied, and valuable zoologically. Of equal importance, the list provides overseas workers with an appreciation of the need for caution in their consideration of many of the elements in the Australian leech fauna as at present known.

There has been some progress since the paper was originally submitted. More recent information has been inserted in the text between double brackets.

In spanning a period of 100 years, the literature on the Australian leeches exhibits the stages in the development of descriptive techniques. Earlier descriptions are essentially external, concerned with colour and pattern and give a count of annuli. The latter is constant in the species, but some authors count the annuli as on the venter and others as seen on the dorsum, so that the data given for the one species may differ by 6 to 10 and more annuli. For example, the male genital pore may be described as in the 24th annulus in one account, and the 30th in another.

Whitman (1886) followed Moquin-Tandon (1846) in recognising the annulus containing the ganglion of the ventral nerve cord and marked externally by a transverse row of cutaneous somital sense-organs, as being the anterior annulus of the morphological somite, and the annulus bearing the following nephropore as the last of the same somite. He recognised only 26 preanal somites.

Moore and Castle, independently and from different material, established in 1900 that the ganglion of the nerve cord is placed in the middle annulus of the

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somite, and that the nephridium anterior to it is the nephridium of the same somite. They demonstrated that there were 27 preanal somites. Some descriptions of our leeches are clearly and simply based on Whitman's method, others on that of Castle and Moore; but, unfortunately, there are some descriptions which, while they appear to be based on the method of Castle and Moore, in fact contain a confusion between the two systems. This particularly affects the annulation of the first eight and the last four or five somites and the location of the genital pores. The confusion in this respect may now continue in a third form. Mann 1953 reviewed the theories of the somital morphology of leeches, concluding in agreement with the somital morphology as recognised by Castle and Moore. Recently (1962) he revises this to a preanal morphology of 26 somites. There is no adequate reason for this change. I have attempted where helpful to indicate in the list the method on which a description has been based.

Order RHYNCHOBDELLIDA

Having a small circular pore-like mouth on the anterior sucker through which the pharynx can be everted as a proboscis. Freshwater and marine.

Family Piscicolidae

The body consisting of an anterior sucker, commonly disc-like and wider than the neck of which the posterior portion forms the greater part of the clitellar region; the neck narrower than the following abdomen which terminates in a well-formed posterior cupped sucker. The body regions may not be obviously distinct in the young or in some small species. These are the "fish-leeches", best known attached to the exterior or to the gills of fish, turtles, crustacea, bivalve molluscs, etc. and less commonly taken free-living. Marine and freshwater. Knight-Jones (1962) and Soos (1965) give keys to genera and catalogues of the species in this family.

1. Austrobdella translucens Badham 1916

Badham described a new species and established a new genus for small (13·0 mm. long) transparent leeches found as ectoparasites on sand-whiting (*Sillago ciliata*) taken near Port Jackson, N.S.W. The body regions are well-defined; eyes, one pair; somites, 6-annulate; a continuous longitudinal contractile vessel along each side of the abdomen external to the muscular envelope; testes, 5 pairs; crop caeca, 6 pairs. The type is in the Australian Museum.

The species is recorded also from *Notothenia* at the Kerguelen Islands. The genus is recorded also from Greenland.

2. Austrobdella bilobata Ingram 1957

Large, up to 35·0 mm.; transparent to opaque; blue-blackish above; no eyes; crop caeca, 12 pairs; testes, 5 pairs. From the common flounder, *Rhombosolea tapirina*, Pittwater, Tasmania.

Genus Branchellion

Marine fish-leeches having flat plate-like gills on nearly all somites of the abdomen.

3. Branchellion australis Leigh-Sharpe 1916

Up to 35·0 mm. long; 31 pairs of gills on the abdominal region with 11 pairs of pulsatile vesicles; testes, 6 pairs. On *Raja lemprieri*, Port Victor, S.A.

4. Branchellion lineare Baird 1869

Inadequately described from a specimen $\frac{1}{2}$ inch long from *Mustelus*, King George Sound, North Australia, and not recognisable again from the description. Gills simple, not "puckered"; 32 abdominal annuli. The original specimen is stated to be no longer available at the British Museum.

5. Branchellion parkeri Richardson 1949

Twenty to 40·0 and exceptionally up to 75·0 mm. long ; 31 pairs of gills but only 10 pairs of pulsatile vesicles ; testes, 5 pairs. Known (Ingram, 1957) from *Raja lemprieri*, *Pristiophorus*, and *Dasyatis*, and originally from New Zealand. Type, Dominion Museum, Wellington, N.Z.

6. Branchellion punctatum Baird 1869

Up to 1½ inches long. The description is generalised and the species not recognisable again unless Baird's statement that " the gills are larger on the posterior portion of the body, simple, not puckered on the margin " does describe a distinctive feature of a leech having " about 32 segments in the body ". From *Myliobatis*, King George Sound, North Australia. The original specimen is said to be no longer available at the British Museum. Blanchard identified the leech figured by MacDonald (1877) from Shark Bay, W.A., as *B. punctatum*, but MacDonald's leech shows 29 pairs of gills, which would be a low number for a leech having about 32 abdominal annuli.

7. Ichthyobdella australiensis Johansson 1911

Known from one specimen 1·9 mm. long. The body regions not distinct ; eyes, two pairs on the expanded anterior sucker ; typical somite possibly 4-annulate ; posterior crop caeca apparently united but briefly bilobed distally ; testes, probably 6 pairs. From shallow water, sandy bottom with plants, near Geraldton, Champion Bay, W.A. Inadequately known and possibly unrecognisable again with certainty in the absence of a known host. The size given is curiously small.

8. "Ichthyobdella" platycephali Ingram 1957

Length, 23·0 mm.; body regions distinct ; two transverse dark bands across the disc-like excentrically attached anterior sucker ; body elongate, smooth, brown above with three pairs of longitudinal light bands ; the wider posterior sucker mottled above ; somites, 14-annulate, the annulations faint ; posterior crop caeca united, with (?) two fenestrae ; testes, 5 pairs. From *Platycephalus bassensis*, Catamaran, South Tasmania.

Miss Ingram was faced with the difficulty that her leech more closely resembles *Johanssonia abditovesicula* Moore 1952 of Hawaii, than Moore's species resembles the genotypic species and *J. pantopodium* which are the only two other species in this genus. It is quite likely that " *I* ". *platycephali* and *J. abditovesicula* together constitute a new genus which would resolve a current difficulty in *Johanssonia*. Ingram's reference of her species to " *Ichthyobdella* " follows a practice for new species of fish-leech which are, in general, simple in form and of confused generic relationship.

9. Ozobranchus branchiatus Menzies 1791

A small white leech about 25·0 mm. long with distinct body regions ; eyes, one pair ; 7 pairs of filiform gills crowded on the lateral margins of the anterior half of the abdomen ; found as ectoparasites on marine turtles of warmer waters, possibly on dolphins, etc. MacDonald (1877) figures this species from Shark Bay, W.A. but without identification. Referred to by Goddard (1910b) but not in such manner as to make definite that he had handled a specimen from Australian waters.

((Through Mr. John Goode, I now have specimens of an ozobranchid from Murray River turtles. It has simple elongate undivided gills. It is a new species requiring a new genus. Otherwise, ozobranchs are known in freshwater by only a single species in North India.))

10. Platybdella michaelseni Johansson 1911

Known from two small leeches taken in the vicinity of Fremantle, Cockburn Sound, and others at Warnbro Sound, W.A. Length 6·9 mm.; longitudinally striped ; elongate ; the regions distinct ; posterior sucker very large ; somites, 6-annulate ; testes, 5 pairs. No host given.

Moore (1938) suggested that this species might be based on juveniles of the antarctic *Cryobella levigata* Harding 1922. He examined material taken from " behind the gills " of *Trematomus hansoni*, finding these leeches to be 12-annulate and accordingly placed *C. levigata* in the genus *Platybdella*. Harding's leech was uniform brownish above and below ; up to 29.0 mm. long ; testes, 4 pairs ; posterior crop caecum single, terminating in two distal pouches. Knight-Jones (1962) and Soos (1965) retain *Cryobdella*.

G. Pontobdella. Tapering cylindrical leeches ; regions not distinct ; 2-annulate to 5-annulate ; strongly tuberculate ; 6 to more tubercles per annulus. Leeches of such description are so strongly characterised that the genus now includes a range which would not be acceptable in another genus of leeches. (The New Hebridean *Stibarobdella superba* Leigh-Sharpe 1925 is known only from the original incompletely described specimen. It is 4-annulate but distinct in having only 4 major tubercles on the dorsal aspect of the abdominal somite and only lesser ones below. It can well be expected in Australian waters.)

11. Pontobdella australiensis Goddard 1910

A 3-annulate uniformly tuberculated cylindrical leech, 20·0 mm. long ; host unknown ; possibly collected in the vicinity of Sydney. Inadequately described and the description confused by reference to a resemblance to *P. muricata*, a 4-annulate species of the Atlantic.

12. Pontobdella biannulata Moore 1957

A small leech up to 20·0 mm. in length taken at southern sea-stations by the BANZARE and remarkable as a cylindrical leech with the neck finely annulate (3-annulate) and lacking tubercles and the abdomen 2-annulate, coarsely tuberculate with the tubercles appearing as though arranged in spiralling rows. No eyes or eye-spots. No record of host.

13. Pontobdella leucothela Schmarda 1861

Small, 18·0 mm. long ; apparently 3-annulate, the middle annulus the wider and with 4 large tubercles ; the first and third annuli with 13 small tubercles ; the neck of 15 annuli ; yellowish-grey. From Port Jackson, N.S.W. Figured but this is not helpful. The tuberculation does have some agreement with that of Harding's *S. superba*.

14. Pontobdellina macrothela Schmarda 1861

This common pontobdellid of warmer oceans, an ectoparasite of hammer-head sharks was recognised by Goddard (1910a) on material from the Brisbane River. It is known from 50·0 mm. to 95·0 mm. in length. The neck and body are strongly distinct with an obvious clitellum of 5 uniformly tuberculated annuli and a sixth short naked annulus ; neck and body strongly tuberculate ; the abdominal somites with 4 large and 2 small tubercles above and 6 below on the middle annulus, the first and last annuli with 16 tubercles. There are good specimens in the collection of the Australian Museum. *Pontobdellina* is given only subgeneric status by some authors.

15. Pontobdella rayneri Baird 1869

Baird briefly characterises a pontobdellid found on *Rhinobatis* at Shark's Bay, as : a small leech, one inch long contracting to three-quarters of an inch in spirit ; the neck and body almost continuous, covered with tubercles, separated

by a clitellum of 5 tuberculated annuli ; 3-annulate, with the middle annulus on the body somite carrying larger tubercles ; the anterior sucker small, with 6 papillae and two subtriangular brown areas.

Johansson (1911) recognised this species in a further specimen also from *Rhinobatis* at Shark's Bay. This is 3-annulate, the middle annulus the longer and with 4 large tubercles above and below, where there are also 3 small tubercles in the middle area (11 in all), and 18 on the shorter first and third annuli ; clitellum of 5 tuberculated annuli. This specimen was 10·0 mm. long. Moore (1957) identified 5 specimens from a Port Jackson shark caught off Hobart as belonging to this species. Small 3-annulate pontobdellid leeches are well-represented in the collection of the National Museum of Victoria. Where noted, these are from the Port Jackson shark.

16. Pontobdella rugosa Moore 1938

A 4-annulate pontobdellid of medium size (40·5 mm.), having 8 equivalent tubercles on all fully developed annuli of the abdomen and few if any median tubercles ; neck continuous with the abdomen ; poorly defined clitellum of 5 (6 or 7) tuberculated annuli. Described first from Commonwealth Bay, King George V Land, host not recorded ; later from stations at sea, and with some doubt from *Trigonorhina fasciata* caught near Hobart, Tasmania.

17. Pontobdella tasmanica Hickman 1942

Originally named *P. verrucosa* (nom. preoc.). A 3-annulate pontobdellid having 8 tubercles on the middle annulus of the abdominal somite and 12 on the first and last annuli ; clitellum of 5 tuberculated annuli. Up to 80·0 mm. From Sandy Bay, Hobart, Kingston, Tasmania, and (Ingram, 1957) from a skate at King Island. The type is in the Australian Museum.

18. Semilageneta hilli Goddard 1908

A freshwater leech for which Goddard established a new genus in the Glossiphonidae, later (1910b) suggesting it should be in the fish-leeches and noting that it might even require a new Family, so that its position here is doubtful ; but if it is a piscicolid it will be the only fish-leech known from our freshwaters. The single specimen taken free-living near Oberon N.S.W. was destroyed. No size is recorded. A pale-green leech, broadly pear-shaped ; distinct papillae on somites i to iv, smaller on v to xi, and absent posteriorly. The genital apertures apparently united into a single aperture on the posterior portion of annulus 21. Goddard originally considered that the posterior sucker consisted of 14 fused somites (not the usual 7), but departed from this view later on.

The data is now incomprehensible. No such animal is known elsewhere. Knight-Jones (1962) does not refer to it in his review of the Piscicolidae, nor does Soos (1965). Mann (1962) regards it as a glossiphonid of uncertain subfamilial status.

19. Trachelobdella leptocephali Ingram 1957

Up to 20·0 mm. in length, taken from the gills of *Leptocephalus conger*, Tasmania. Elongate with distinct body regions ; 13 pairs of pulsatile vesicles on each side of the abdomen, the anterior vesicles the larger and the few last posterior much reduced ; genital pores separated by 2 annuli ; testes, 5 pairs ; posterior crop caeca fused and extending nearly to the anus ; anterior sucker about equal to the width of the neck and bearing 2 or 4 pigmented patches which may be eyes ; 6-annulate.

Pinto (1923) records *Trachelobdella australis* Blanchard 1900 as from Australia. The one specimen then known came from off Tierra del Fuego. Moore (1957) established a new genus *Trachelobdellina* for *T. glabra*, n. sp., a leech of

29·0 mm. in which the narrow neck is equal in length to the abdomen ; 6- or 8-annulate ; 12 pulsatile vesicles ; the skin smooth except for numerous sensory papillae ; genital pores separated by 3 annuli. This was taken in our southern ocean waters and it can be expected to be near our coasts.

Family Glossiphonidae

Freshwater leeches commonly of small size ; characteristically depressed, convex above ; the body without distinct regions, appearing somewhat ovate, tapering anteriorly to a narrowly rounded head with a shallow open ventral sucker ; the mouth, a small circular pore within the sucker or on the anterior rim ; the dorsum roughened by obvious papillae, or smooth ; the body generally obviously 3-annulate. Most commonly found attached to the lower surface of stones, submerged logs, lily-pads, etc., or sheltering in the submerged axils of bulrush and other aquatic plants. When removed, roll up lengthwise. Eggs and young carried on the venter which is then shallowly concave to contain them.

1. Clepsine, n. sp. Johansson 1911

Described from a single small (3·5 mm.) leech from Broome Hill, W.A., having two pairs of eyes arranged in transverse pairs, an eye on either side of the mid-line and the second pair closely follows the other ; testes, 6 pairs. Otherwise described so that it may only be recognised again from a specimen of nearly similar size from the original locality. The reference of the animal to *Clepsine* is not helpful, as the genus operated somewhat as a catchpot and species have been transferred from it to five other genera. There is only mention of the similarity of the internal anatomy to *Helobdella stagnalis* as a guide to possible generic standing.

2. Clepsine octostriata Grube 1866

I do not have Grube's original account, but later (1871) it seems that the species is based on only a single specimen from Rockhampton, of small size, the length not given but at least 10·0 mm.; 58 obvious annuli, each carrying a transverse row of 10 or more tiny papillae ; eyes, two, separated by a distance equal to the diameter of the eye and placed as far from the anterior margin as from the lateral edge ; greyish-yellow dorsally with 8 longitudinal dark red stripes, the median four narrow and of equal width and separated by about half their width ; the other stripes paler and wider, and the most lateral separated from the edge of the body by a faint grey stripe, so that if the latter are excluded, there are 8 stripes ; ventral surface paler than the dorsum ; the whole somewhat translucent as the crop pouches can be seen as green ; genital apertures not observed.

It appears that Goddard (1909) was aware of some such leech in the vicinity of Brisbane and considered that " the genus is extremely abundant throughout Eastern Australia ", but this is now confusing in meaning. It is quite likely that *C. octostriata* can be recognised again.

3. Glossiphonia australiensis Goddard 1908

Described from specimens up to 15·0 mm. long from a creek near Oberon, N.S.W. and, more recently (1957), by Ingram from 2·5 mm. to 39·0 mm. from the lower surface of stones and wood in Lake Dulverton, Oatlands, Tasmania. Soos (1966) recognises this as a species in the g. *Glossiphonia* characterised in having : a single annulus between the genital pores ; 3 pairs of eyes situated in annuli 2, 3, and 4 ; one post-anal annulus ; testes, 6 pairs ; the sixth pair of crop caeca elongated posteriorly and with many (10 or 11) simple lateral diverticula.

Ingram reports that the last crop caeca appear late and that small specimens may show only 5 pairs of simple caeca ; somewhat larger specimens, simple sixth caeca which may actually be asymmetrical ; but large specimens always have

six pairs of diverticulate crop caeca. She describes her specimens as having a greenish tinge, lacking conspicuous patterning ; flesh-coloured, opaque ; segmental papillae absent.

4. Glossiphonia heteroclita Linn. 1761

This leech of America, Europe, Asia, Central and East Africa was recognised in Australia on the evidence of a single specimen taken from the lower surface of a floating timber from Narara Creek in the vicinity of Gosford by Goddard (1909), but with some doubt on the certainty of this identification.

His specimen was small (8·8 mm. contracted) ; the skin smooth, lacking papillae ; the body clear, gelatinous ; crop and crop caeca appearing as yellowish-brown structures ; annuli, 68 to 72, inconspicuous ; eyes, 3 pairs, in the form of an arc, the most anterior being small and close together in annulus 4 ; the intermediate pair large and further separated, in 5/6 ; the third pair equal to the second and close to them in 6.

This sparse data, so far as it goes, conforms to *G. heteroclita*, but there seems to be no further account of Australian material. Soos (1966) does not refer to this record.

5. Glossiphonia inflexa Goddard 1908

Described from a single specimen, 14·0 mm. long, collected near Waverley, Sydney, as being : broad ; flat ; pale sage-green in colour ; semi-translucent ; smooth ; indistinctly annulate, with 70 annuli ; lacking eyes ; sense-papillae obvious in the middle region of the body ; anus on the dorsal surface of the last annulus ; the genital pores united as a common pore on annulus 28 ; 3-annulate.

There is little certainty in this description which might lead to recognition of the species again. Soos (1966) lists this as a *species inquirenda*. He groups three species as having a common pore for the reproductive systems ; *G. tasmaniensis*, *G. heteroclita*, and *G. weberi*. Of these only *G. heteroclita* lacks a post-anal annulus and the number and arrangement of the eyes is highly variable in this species.

6. Glossiphonia intermedia Goddard 1909b

Described from two leeches taken attached to submerged timber in the bed of Orphan School Creek, Fairfield. A leech capable of remarkable extension. Goddard described it as 14·0 mm. contracted, 4·6 mm. wide in the posterior part of the body, but capable of extending the anterior half of the body to give a maximum length of 33·0 mm.; eyes, typically 4, a pair each in annuli 5 and 6, the eyes of a pair being spaced out somewhat more than half the width of the annulus (and an eye-like structure at 3/4 in one specimen) ; mouth in annulus 4 ; crop with 6 pairs of caeca, the posterior elongated and each with three simple lateral diverticula ; anus followed by 2 annuli ; testes, 6 pairs ; genital pores separated by one annulus in xii ; blue-grey over the dorsum of the anterior half of the body and dirty yellow over the posterior half ; prominent sensory papillae lacking ; unornamented.

Soos (1966) sustains this as a valid species. There seems to be no record other than the original account and the species needs careful re-examination. As for example, Goddard wrote " The anus lies between the second and third last annuli ". This can be read that two annuli follow the anus, as in the above account, but this is unique among the ten species now retained in the genus so that the statement may be ambiguous.

7. Glossiphonia tasmaniensis Ingram 1957

A small leech, 7·0 mm. to 10·0 mm. long ; colourless to grey-white ; transparent in life attracting attention by the pattern of the dark crop diverticula. Taken attached to the lower surface of stones in the creek entering Curryjong Rivulet in the vicinity of Antill Ponds, Tasmania. Eyes as a pair on each of

annuli 5, 6, 7, arranged in divergent longitudinal lines ; 70 annuli ; surface very finely granular ; no segmental papillae ; genital pores united at 27/28 ; testes, 4 or 5 pairs ; 6 pairs of crop caeca, last pair elongated posteriorly with a small number (4 or 5) of large simply lobed lateral diverticula ; one annulus behind the anus ; egg-bearing in March.

Ingram suggested the possibility that this might be only a variety of *G. heteroclita*, but Soos (1966) sustains this as a valid species.

8. Placobdella bancrofti Best 1931

Originally located in the genus *Helobdella*, this species was based on three small specimens, 6·8 mm. long, removed from the turtle *Emydura krefftii* at the Burnett River, Queensland.

There is no record of colour, and much general external detail is lacking, as the description was taken from two leeches prepared as whole mounts and the third in transverse serial sections. The mouth, subterminal, a perforation in the second annulus ; one pair of eyes separated by less than their diameter ; genital apertures separated by a single annulus immediately anterior to ganglion xii ; testes, 6 pairs ; crop caeca, 7 pairs, the last pair extending posteriorly with a few (3) broadly open lateral diverticula ; anus opens (?) in the centre of the disc of the posterior sucker as seen in the whole mount.

A known locality and host give the promise that this species might be recognised again. With the mouth in the second annulus and with 7 pairs of crop caeca, these leeches fall outside of *Helobdella* as at present understood. It is more suitable at this time to refer the species to *Placobdella*, following a practice of others for leeches parasitic temporarily on reptiles and amphibia. This is a simple provisional convenience.

((Placobdellid leeches are common on Murray River turtles and may well be Best's species. Elsewhere turtle-leeches have a wide distribution.))

9. Placobdella bdellae Ingram 1957

A small, coarsely papillate, almost colourless, transparent leech, 11·0 to 13·0 mm. long ; one pair of pigmented eyes at 3/4 ; mouth in ii ; middle annulus longer and more coarsely tuberculated than the contiguous annuli so that the 3-annulate condition is obvious ; large papillae in 4 distinct longitudinal rows with a fifth median row in the mid-region of the body ; 70 annuli ; genital apertures separated by 2 annuli, located at 27/28 and 29/30 ; testes, 6 pairs ; crop caeca, 7 pairs all with many small diverticula and the seventh pair directed posteriorly.

Described from specimens taken from the buccal cavity of the lamprey *Geotria australis* in Tasmania. The leeches survive apart from the host. The location is unusual. Other leeches known from cyclostomes are entirely ecto-parasitic, attached to the open skin.

Order ARHYNCHOBDELLIDA

Most commonly elongate, more or less somewhat depressed or some cylindroid leeches ; broader posteriorly ; tapering anteriorly to a head consisting mostly of a shallow scoop-like ventrally directed oral sucker with well-formed ventral and lateral margins overhung by a flexible upper " lip " of several annuli ; the mouth a slit-like or three-cleft opening leading into a buccal chamber in which for most there are 3 muscular ridges (median dorsal, paired ventrolateral) terminating in jaws which may be unarmed, equipped with a cutting plate of chitin, or with chitinous or calcareous teeth, but in some few there are only two jaws ; the ridges continue into the fixed muscular pharynx ; essentially 5-annulate but often with secondary or further subdivision of these annuli ; a clitellum, the eggs being deposited in a cocoon attached to sticks, stones, plants, etc. Freshwater and terrestrial.

Family Erpobdellidae

Slender, linear in form, somewhat rounded in section anteriorly, commonly flattened posteriorly and even sharply flanged when swimming ; eyes variable in number and arrangement, even absent, but never as a nearly continuous arch of 10 eyes ; more typically an anterior pair or two pair of eyes and a more posterior two pairs transversely arranged and widely spaced and these may be followed by other eyes ; jaws simple, reduced, lacking teeth or with only one or two simple stylets on each jaw ; pharynx elongate, reaching into x and beyond ; crop lacking caeca, or with only a single small pair. Freshwater, secretive, carnivorous, feeding on worms, snails, larvae, etc.

((I now have three species of this Family additional to those below. These show considerable novelty.))

1. Genus Barbronia Johansson 1918

Not yet reported in Australia although the genus is now known to be widespread in East Asia, India, Malay Archipelago, New Guinea and I had specimens in New Zealand. I now have specimens from Sydney and elsewhere.

These are small (up to 35·0 mm.), slender, reddish, translucent worm-like leeches ; a copulatory pore is situated some 5 annuli anterior to the male pore and another posterior to the female pore but these may be small and the posterior difficult to detect ; the jaws armed each with a small coarse stylet which is very easily displaced.

Such leeches can be found beneath stones in streams, but more readily in submerged rooted vegetation in shallow pools on slow-running streams when the vegetation is examined in water in a white pan.

2. Dineta cylindrica Goddard 1909a

Known from a single contracted specimen about 25·0 mm. long by 2·0 mm. wide, collected from a freshwater pool in the vicinity of Oberon, N.S.W. A cylindrical elongate leech having 115 annuli, but the annulation somewhat obscured by a roughness due to many fine longitudinal lines which gives an appearance of tuberculation ; 5-annulate but many annuli superficially subdivided further ; genital apertures separated by 5 annuli ; 3 pairs of eyes on annuli 1, 3, and 6 ; 3 muscular ridges in the pharynx ; testes about 7 pairs.

Regarded by Goddard as possibly a species of the genus *Dina*. It is retained by Soos (1966) as *Dineta*, characterised as lacking stylets and accessory eyes and with $b_5 < b_6$ which is not further subdivided. It requires further examination, since among other features of interest, Goddard refers to a peculiar proboscis-like outgrowth of the oesophagus or pharynx which is a novelty. It may not be confused with *Barbronia sp.* where the eyes are arranged as an anterior median pair on the upper lip and two pairs each in a lateral position on about the third annulus following.

3. Erpobdella sp.

Goddard (1909b and 1910c) refers briefly to the occurrence of leeches, which he assigns to this genus, in the vicinity of Sydney and in the Maitland district, but gives no further data. Pope (1966) figures an erpobdellid cocoon (not *Barbronia*).

Family Hirudidae

Ten-eyed leeches with the eyes arranged as an ocular arch near to the margin of the upper lip and on the first few complete annuli with longer intervals between the third and fourth, and fourth and fifth eyes on each side ; some with a median longitudinal furrow on the lower surface of the upper lip ; nephridiopores ventral ; dorsal somital cutaneous sensillae in 8 longitudinal rows, ventrals in 6 rows ; jaws characteristically armed with a few too many teeth in one or two rows, or

with a chitinous cutting plate, or unarmed ; pharynx bulbous, short, in vii and viii uncommonly reaching into ix ; crop with at least one and often more pairs of large caeca. Terrestrial (not yet known here) and freshwater, predators, scavengers, carrion eaters, and sanguivores.

1. Aetheobdella hirudoides Moore 1935

Known from a single specimen, 107·0 mm. long and 11·6 mm. wide, collected in 1930 from a pond near Cambewarra, near Nowra, N.S.W., and deposited in the British Museum. Moore established a new genus for this leech.

Moderately elongate in form, widest posteriorly, but the lateral margins sub-parallel over the greater length of the body, which tapers abruptly at the anterior end ; generally depressed ; margins rounded ; surface smooth ; eyes, 5 pairs, small, obscure especially the last pair ; 5-annulate (17 such, viii to xxiv inclusive but the latter is incompletely divided on the venter) ; genital pores separated by 7 (possibly 8) annuli ; two postanal annuli ; apparently 11 pairs of testes ; male and female atria minute and embedded in the body-wall external to the longitudinal muscles ; nephridiopores very obvious, having swollen lips, close to the lateral margins on the ventral surface ; jaws small, low, broad, lacking a distinct dental ridge, lacking papillae, and with 21 relatively large blunt teeth having a bilobed base and in one row.

The leech is remarkable in the Hirudidae in lacking an obvious penis and in the minute size of the atria. Moore states that it is of the size and form of *Haemopis lateralis*, which could mean that the body is rather soft and the colouring plain in life.

A. hirudoides has now been recognised as the leech which perforates the conjunctival fold at the upper outer corner of the eye and takes up its position between the skin and skull in various bush-birds (White-eye, Bulbul, Yellow-faced Honeyeater, etc.). It is aquatic but its habits are not yet known.

2. Haemopis sp.

In view of the reference above to *Haemopis*, it is interesting that McCarthy (1962) states that leeches removed from the teat-canal in cattle in Southern Queensland had been identified as *Haemopis* sp., and that the same species had been removed from the udders of cattle at the Townsville Abattoir.

Genus Hirudo Linn. 1758

As the " classical " genus of 10-eyed jawed striped leeches, new species described from many countries were almost automatically placed in this genus during the last century and even more recently. European experience led to the view that there would be only one such species in each continent. This is now proven incorrect, but it resulted in the reduction of many species without reference to material to the level of synonyms of the first-named species. The genus is now more closely defined. Caballero (1956) lists 21 genera in the family. The true generic homes for the species listed here as " *Hirudo* " is still to be determined for any which may be recognised again and found valid as species.

3. Hirudo elegans Grube 1866

Described from a leech taken at Rockhampton, Q. The description provides little information beyond this being " *Hirudo* " in eyes, form, etc.; the colour pattern on the dorsum being a median wide, intense dark stripe and two other stripes of lesser intensity, all five each with a delicate black border ; the venter, pale olive.

There is nothing essential in the description which can give definite recognition of this species other than in a collection at the original location. I have seen specimens of " *L.*" *australis* with fine black borders on the dorsal stripes as described above.

((Grube (1871) was in error in crediting his original descriptions of *H. elegans* and *H. novemstriata* to his paper published in 1866. The descriptions are contained in his paper of 1867 on land-leeches. I have now recognised *H. elegans* in specimens sent me by the Rockhampton Field Naturalists' Club, and at Grafton. It is assigned to a new genus : Richardson, in press, *Mem. Queensl. Mus.*))

4. Hirudo novemstriata Grube 1866

Described from a specimen from Rockhampton as being a most slender leech, 12 times as long as wide, the anterior end tapering and the sucker so narrow as to appear lumbricine ; annuli appear long and with a transverse row of about 10 papillae above and below giving the appearance of a low ridge. The dorsum is described as marked with 9 dark lines (or 8 light longitudinal stripes) of equal width excepting the unpaired darker stripe which is broader, and the spaces on either side, wider than the paired dark stripes ; lateral edgings, wider, light and not set off from the uniformly coloured plain venter. The paired stripes commence at the 10th annulus. Male pore at the rear edge of 24 ; female pore in annulus 29.

Goddard (1909) considered this a synonym of "*L.*" *australis* which Johansson (1911) regarded as quite incorrect. The latter figures the patterns in "*L.*" *australis* as known to him in specimens and from published figures of this and other species which strongly supports his opinion. I have not yet seen such a pattern in "*L.*" *australis*, where in all specimens I have so far seen, the dark stripes commence as such in annulus 6 and none show more than 5 dark stripes.

5. Hirudo quinquestriata Schmarda 1861

This large striped leech was described as being 150·0 mm. long ; with 80 annuli ; the dorsum, brown with a very narrow median longitudinal stripe and four other wider stripes which are narrower than the intervening light stripes ; small eyes forming an arch ; large jaws with 48 to 50 sharp-edged teeth of diminishing size ; the anterior genital pore behind annulus 25 ; the caudal sucker of the width of the body and narrowly attached. It was stated to be not unusual in the Cooks River, as well as in waterholes at the foot of the Blue Mountains.

This was made a synonym of *Hirudo australis* Bosisto by Grube in 1868 according to Benham (1907), but the name *quinquestriata* continued in use, for example Vaillant (1890), Blanchard (1893), Parker and Haswell (1897), and in the pharmacopeias until quite recently. McCarthy (1962) quotes Seddon (1950) as referring to a leech under this name taken from the teat-canal of a cow.

In establishing the genus *Limnobdella* for a new leech from Mexico, Blanchard (1893) remarked that other known species would be accomodated in this genus, and indicated *H. quinquestriata* as one such. Brandes (1901) following Grube and Blanchard accordingly lists *Limnobdella australis* (Bosisto), and follows this with the description and localities as given by Schmarda, excepting that he gives 103 as the total number of annuli. This was repeated in a reduced form by Pinto (1923), but with the addition of a comment that the length was 75·0 mm. in alcohol, obviously a figure derived from Goddard's account of *australis* (1909b).

Schmarda's account of the distribution of *quinquestriata* reads more like hearsay than personal experience, suggesting his specimen might have been an exceptionally large one obtained from a Sydney pharmacy. Recently with the help of the Pharmacy Board of New South Wales, I have been in touch with senior pharmacists but none have recalled a leech of this size.

It can be noted that Schmarda approximated closely in the counting of annuli. For example, he gives 96 annuli for his *H. multistriata* of Ceylon, almost certainly *Hirudinaria manillensis* (Lesson 1842) which has 102 annuli. The low figure of 80 annuli could only indicate an haemadipsid, but the illustration does not support this conclusion.

It continues difficult to accept that the great length and the unusually low count of annuli are both simple errors. If they are not such, the confusion between two possible species has been greatly augmented by the transfer of the description of *quinquestriata* to *australis* and there remains the possibility that a large uncommon sanguivore may be rediscovered presumably in the coastal belt.

((I have recently handled specimens of '*L.*' *australis* which reached an extended length of 120 mm. and cannot now sustain *quinquestriata* as a separate species, especially as the dentition figured by Schmarda agrees with *australis* where it has proven to be specific in value.))

6. Hirudo tristriata Schmarda 1861

Described as differing from *H. quinquestriata* in having 3 black stripes on the dorsum which is a dirty-greenish colour, and the abdomen greenish-brown. From Bathurst but also supposed to be present in the Macquarie and Murray Rivers. The drawings were lost. Vaillant (1890) refers to this species, but in general it has been omitted from the literature. McCarthy (1962) quotes Seddon (1950) as referring to a leech under this name taken from the teat-canal of cattle, but I have not been able to find this in Seddon.

From the description and location, this is almost certainly '*L.*' *australis* in which in many specimens I have seen, the median black stripe is broad occupying a third and more of the width of the dorsum, but subdivided by two very narrow paler lines extending from iii to xxvi, passing through the paramedian sense organs and of no greater width than these structures, so that at first sight the animal shows only three stripes.

7. Hirudobdella sp. Goddard 1910c

Goddard writes of a species of this genus present in Australia but gives no other information. There is no later information.

The genus *Hirudobdella* was established by Goddard for *Hirudo antipodum* Benham 1903, which is remarkable for having the jaw much higher than wide, lacking teeth, but with a straight not curved distal margin where the cuticle is folded into a cutting edge with irregular rounded prominences and almost nothing of teeth of the usual pointed kind.

This leech is 48·0 mm. long, with 5 longitudinal dorsal black bands ; obvious dorsal somital sensillae ; genital pores separated by 5 annuli ; testes, 7 pairs. It was discovered among the wet roots of grasses and other material at the bottom of shearwater nests on Open Bay Island off the West Coast of the South Island of New Zealand. No type or other material exists, nor has it been found again at the type locality (W. Benham, pers. comm.).

We can only assume that Goddard handled leeches coming close to this description.

8. " Horse-leech " of Bosisto and Becker 1859

Included here since from their accounts it would seem this is a rather common leech of large size which has not been further described since the original accounts, nor referred to in the literature, excepting by Johansson (1911) who considered it to be a variety of *Hirudo australis*. This seems improbable.

A 10-eyed leech having an elongate depressed body widest in the posterior third and tapering gradually to the narrow head ; annuli, 94 with ridged folds of no distinctive character ; dark rusty colour above and below with a longitudinal median dorsal black stripe and three faint brown (? narrow) parallel lines on either side. It becomes grey in spirit.

In lagoons, pools and creeks (? Victoria). As a pharmacist, Bosisto would be familiar with accounts of the european horse-leech, a non-sanguivore, at best only a moderate swimmer, found under stones, logs etc. in deeper pools and the

littoral of lakes, with a preference for marshy ground. He could be expected to distinguish between his Australian medicinal leech and another of the " horse-leech " kind.

9. " Limnobdella " australis Bosisto 1859

This leech was loosely described by Bosisto, and well-figured by Becker (1859) in a separate paper, the material obtained from the Murray watershed which Bosisto refers to as yielding only this, the best blood-sucker for medicinal purposes. Bosisto used the name *Hirudo australis*.

Dark olive above, sometimes approaching black, with 4 well-marked yellow longitudinal stripes, the two outer wider than the inner ; the lateral margins being of the same colour as the venter which is deep ochre yellow sometimes spotted with olive-green. Eyes 8 ; body narrow, oval, about 100 annuli. From Becker, it is clear that the median dark stripe is the narrower, about equal to the light lines on either side of it, and half the width of the inner pair of dark lines, which are barely half the width of the light lines lateral to them. This conforms to the pattern of Schmarda's *quinquestriata*.

So far as I have been able to find, there was no further published description of a leech under the name *australis* until Goddard's account in 1909b, excepting in Brandes (1901) who, under this name, repeats Schmarda's description of *quinquestriata*. In this period of fifty years it was the latter name which was widely used (see above), as for example by Baird (1869), who footnoted that the few specimens preserved from a shipment of medicinal leeches from Australia to London were of Schmarda's species. It should be mentioned that Bosisto hoped for an export of leeches to England where the european medicinal leech was becoming scarce. The Australian leeches were liberated in the Thames.

Goddard accepted that *H. quinquestriata* was a synonym of *australis* and that the leech belonged in *Limnobdella* Blanchard (1893). He describes *L. australis* as a leech not exceeding 76·0 mm. preserved ; smooth surfaced ; lacking any trace of sensory papillae ; genital pores separated by 5 annuli ; testes, 10 pairs ; the jaws with 48 to 50 long strong pointed teeth as a series diminishing in height and diameter. He records the leech as the commonest leech in New South Wales, abundant in freshwater creeks and moist places and extending into Victoria and Queensland. He states, it is a vigorous biter and of much annoyance in bush travel. (It may well be this remark which has resulted in some small confusion between this aquatic leech and the haemadipsine bush-leeches.)

He described the somital annulation ; but gives essentially the formula as in Parker and Haswell (1897) which was stated to be based " Partly after Whitman ". Goddard gives the impression that he is following the method of analysis established by Castle and Moore. He makes it quite clear that he did not distinguish cutaneous somital sensory organs. The formula he presents is : uni-annulate, i and ii ; 2-annulate, iii, iv, xxiv, xxv, xxvi ; 3-annulate, v, vi ; 4-annulate, vii ; 5-annulate, viii to xxiii (a total of 16 such).

Johansson (1911) gives an account of colour pattern variation in *H. australis* on specimens from Western Australia for the most part, and from the figures of other authors. In 1918, he described *Hirudo catenulata* from New Caledonia, a leech which he considered was intermediate between *Hirudo* and *Limnobdella*, so that *Limnobdella* was invalid. This proposal has not been followed by others. Caballero (1930) redescribed in detail the genotype, *L. mexicana*, and subsequently established a new genus *Pintobdella* for most of the species of *Limnobdella* other than *L. mexicana*, from which *L. australis* differs in such manner that at present it is more proper to consider this a doubtful generic position for our species. For example, in *L. mexicana* the teeth are relatively few, spaced, somewhat low conical with a complex base, strongly contrasting with the tall, seemingly cylindroid, numerous, crowded teeth of *australis* which form a continuous cutting edge. Dr. Caballero has kindly sent me specimens of *mexicana*. These differ strongly in general facies from *australis*.

Goddard reduced *Hirudo mauiana* Benham 1907, a New Zealand leech, to synonymy with "*L.*" *australis* as a possible distinct variety which I now regret I followed myself (1947). Benham figured a jaw in which the teeth are spaced, low conical, so unlike the teeth of the Australian leech as I have now seen them that the two can hardly be regarded as the same species. Also, Benham did not detect somital sense organs in living or freshly prepared specimens which he could not have overlooked had these been "*L.*" *australis*.

I found it most difficult to identify leeches before me as "*L.*" *australis*. All reasonably prepared striped leeches showed obvious somital cutaneous sense organs on all somites. Goddard stated that these were lacking. Ingram (1957) partly remodelled Goddard's analysis of somital annulation. She observed these only in the anterior part of the body. The annulation of the incomplete somites in my specimens differed strongly from the formula as given by Goddard and Ingram. It was not until I recognised that Goddard had not properly followed Castle and Moore in his analysis of these regions, that I could bring my specimens into agreement with his account.

Pope gives photographs (1963) and a general account of this leech (1965).

((There is a second and new species congeneric with *australis* in New South Wales. It is highly aggressive. An account of both species is in preparation.))

Family Haemadipsidae

Three-annulate to 7-annulate; the body elongate conical to almost cylindroid in full extension when the posterior sucker equals or exceeds the diameter of the body; eyes, 10, prominent, arranged as a marginal arch on the dorsal aspect of the anterior sucker, with the 4th and 5th eye separated more widely (2 annuli) than the spacing between the others; somital sense organs in 6 rows above, 4 below, laterals absent; lacking a median furrow on the lower surface of the upper lip; nephridiopores lateral, the first anterior near to the 5th eye, the 17th beneath a flap-like "auricle" above the posterior sucker or combined into a common median pore on the ventral surface; somites xxv to xxvii inclusive, uni-annulate. Terrestrial. Bush or forest leeches.

The two genera of Eastern Australia, *Philaemon* (4-annulate) and *Chtonobdella* (5-annulate) are two-jawed, lacking the median dorsal jaw. Blanchard (1917) describes two species of the 5-annulate, 3-jawed genus *Haemadipsa* from New Guinea but their generic status is uncertain since he does not refer to the number of jaws. These may be *Chtonobdella* which is known also in the New Hebrides (*C. parva* Moore 1944). The 6-annulate genus *Phytobdella* is known from two species in New Guinea, but not yet in Australia.

((Soos, 1967, provides a key and catalogue of the Haemadipsidae (*Act. Zool. Acad. Hungar.* 13 (3/4). He accepts Augener's recognition of *tristriata* as a species of *Chtonobdella*.))

Genus Chtonobdella Grube 1866

Two-jawed, 5-annulate haemadipsids. The Australian species appear in the literature also as *Hirudo*, *Chthonobdella*, *Geobdella*, *Moquinia*, *Haemadipsa* and *Trocheta*.

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* Included in the collections of the National Museum of Victoria is a specimen of *Philaemon* named specifically and labelled "Type", and a second haemadipsid labelled as "Type" of a new genus and species from Fife Bay, N.G. The evidence on the label indicates that the latter specimen may be part of the collection made by Mr. T. Steel, who provided the specimen from the Fife Bay district, which Goddard (1910a) described as *Geobdella striata* n. sp. which is at present of uncertain generic status. The generic name on the label indicates the leech resembles *Haemadipsa*. I have failed to find any published description of these "Types". Caballero (1956) does not list the generic name.

1. Chtonobdella australiensis Lambert 1899

Described as *Geobdella* from specimens from Moss Vale, N.S.W. as : preserved, some 48·0 mm. long ; 95 annuli (including the 1st to 3rd pairs of eyes) of which 5 is the first complete annulus and 92, the last ; male pore at 29/30, female at 36/37. In alcohol, the anterior region to annulus 39, dull brown and posterior to this is bluish black ; a distinct white line on each side encloses the nephridiopores ; on each side of the mid-dorsal line in 85 and 86, a small white oval patch, another in 84 and in line with this a white line extending from 89 to 92 ; on either side of the mid-line, a diamond shaped area in 90 extending into 89 and 91 ; a triangular patch at the posterior end, the apex in the mid-dorsal line of 93 and the base in 95 ; annulation (after Whitman), i to iii without furrows ; uni-annulate, xxiii, xxiv, xxv, xxvi ; 3-annulate, iv, v, vi ; 5-annulate, vii to xxii inclusive.

This was not referred to in Blanchard (1917). Pinto (1923) lists the species as *Trocheta* since *Geobdella*, in which Lambert placed it, was a synonym. Otherwise, so far as I have seen, there is no reference until this was made a synonym of *C. limbata* by Moore (1944), an action following Blanchard's view that all 5-annulate bush-leeches from Eastern Australia belonged to the one species.

Blanchard (1917) did not record colour nor pattern. The prominent mid-dorsal stripe and the absence of patches on the posterior part of the body of *C. limbata* contrast with the pattern described by Lambert. In the various collections of bush-leeches sent me from the vicinity of Sydney, the majority of specimens conformed to *C. limbata* in colour and pattern, but from time to time there would be a single specimen differing from this and conforming to Miss Lambert's *australiensis*. Most recently, Mr. H. Battam of Cronulla has sent me a collection of 20 specimens conforming to *australiensis*, and with them one *Philaemon* and one *C. limbata* ; and from Dr. R. E. Barwick, 6 specimens from Clyde Mt., N.S.W. conforming to *australiensis*. I have kept the two kinds of *Chtonobdella* together for some weeks without change in their distinctive colour patterns. Those conforming to *australiensis* show $6\frac{1}{2}$ to 7 annuli between the genital pores, $7\frac{1}{2}$ annuli in one specimen.

In reviewing the several accounts, it became apparent especially in Blanchard that specimens from Queensland and northern New South Wales were recorded as having $7\frac{1}{2}$ annuli between the genital pores, while those having a separation of 7 annuli were from the vicinity of Sydney. This suggested the possibility of northern and southern species of *Chtonobdella*, and that *C. australiensis* might be the southern species. I have not yet seen bush-leeches conforming to *australiensis* in the Northern Rivers Region.

At this time it seems most highly probable that *C. australiensis* may prove to be a valid species.

Miss Lambert's type is in the National Museum of Victoria.

2. Chtonobdella limbata Grube 1866

The original account of *Hirudo limbata* from near Sydney includes the suggestion of *Chtonobdella* as a new genus. It described an elongate terrestrial leech of 30·0 mm. by 4·0 mm.; 5-annulate, with obvious transverse rows of papillae and the dorsum granular on the posterior sucker ; 89 annuli ; the genital apertures at 24/25 and 31/32 ; bottle green in colour and losing the green colour in spirit. In 1867, Grube still referred to this as *Hirudo limbata*, a name continuing with some other authors (e.g. Vaillant (1890), who lists the range as India, Philippines, Japan, Chile, etc. a confusion arising from a misunderstanding of a general statement on the distribution of haemadipsids made by Whitman, 1886).

Grube (1868) is not available to me, but it would appear that here he redescribes material under the name of *Chtonobdella*, which is the basis of the account of *Haemadipsa limbata* in Brandes (1901) : length, 30·0 mm. to 50·0 mm., width

4·0 mm. to 10·0 mm.; posterior sucker, 10·0 mm.; 95 annuli ; male genital pore at 30, or 30/31, and female at 37/38, separated by 7 or 7½ annuli ; median dorsal jaw absent ; ventrolateral jaws with 67 sharp teeth ; dark bottle green in life.

Haswell had sent specimens to Whitman, who (1886) decided that in the absence of the median dorsal jaw and with a separation of the genital pores by 7½ annuli, these required a new genus and he proposed the name *Geobdella*, although he was aware that this was preoccupied and that Grube had suggested *Chthonobdella* (Whitman's spelling) earlier. Because of this, Blanchard in 1887 proposed the generic name of *Moquinia* for *limbata*, but in 1917 he reduced all three to synonymy under *Haemadipsa*. Pinto (1923) removed *limbata* and Miss Lambert's two species to *Trocheta*, considering this to be a systematic equivalent of *Geobdella*.

So far as I find, Blanchard (1917) gives the first new description of *limbata* under this name since Grube. It was based on 17 specimens, including two from the Novara collection at the Vienna Museum. The annulation follows Whitman. There is no reference to jaws, colour, or pattern. Specimens came from near Sydney, from the Upper Richmond River northern N.S.W., and three were from Queensland. From these, he recognised the species as having the male pore constantly at 29/30 and the female pore separated from it by 7 to 7½ annuli.

Moore (1944) gives a full detailed account of the external features of *C. limbata* based on a single specimen (British Museum) from " Dorringo, New South Wales, W. Herron esq ". (Correctly Dorrigo, where I have confirmed locally that Mr. Heron was well-known).

Moore gives the annulation as : uni-annulate, i, ii, iii, iv, xxv, xxvi, xxvii ; 2-annulate, v, and xxiv ; 3-annulate, vi (2-annulate ventrally), vii ; 4-annulate, viii and xxiii ; 5-annulate, ix to xxii inclusive ; genital pores, xi b_5/b_6 and xiii b_2 ; a prehensile papilla on the anterior margin of the posterior sucker ; a median dorsal clear yellow line, lateral to this thickly and irregularly mottled black, yellowish marginal stripes ; venter mottled black.

3. Chtonobdella whitmani Lambert 1899

Described as *Geobdella* and based on a specimen from Woombye, Queensland and others from New South Wales. Up to 40·0 mm. long ; male pore at 29/30, female in annulus 37 so having a separation of 7½ annuli ; annulation is given following Whitman ; body, rusty brown, a more or less distinct light band edged by a dark line on the dorsum with patches of darker pigment on either side with a light band in each occasionally forming a continuous lateral light band along most of the length of the body, excepting the last sixth which is then mottled with dark patches.

The colour pattern is obviously based on preserved material and conforms to *C. limbata* so that Moore is correct in considering this to be a synonym of Grube's species. Pinto (1923) lists this as *Trocheta*.

The type is in the National Museum of Victoria.

Genus Philaemon Blanchard 1898

Two-jawed, 4-annulate haemadipsids. Eastern Australia, New Guinea, Java, Samoa, Juan Fernandez, Madagascar. It should be noted that jaws have not been reported on for specimens from Java, Samoa, and Madagascar.

4. Philaemon pungens Blanchard 1898

Baldwin Spencer sent specimens to Blanchard who provided the above name which Miss Lambert credited to Blanchard and used with her description of the species published in 1898 based on specimens from Victoria and Tasmania : 25·0 mm. to 30·0 mm. long ; two jaws with some 70 fine teeth each ; the median

dorsal jaw lacking ; 79 annuli (including i to iii not indicated other than by eyes) ; genital pores in 26 and 30, separated by 4 annuli ; (following Whitman) uni-annulate, xxiii, xxiv, xxv, xxvi, 3-annulate iv, v, vi, 4-annulate vii to xxii inclusive ; 12 equidistant prominent papillae. Colour, a narrow light brown median longitudinal band with pale green longitudinal stripes on each side broken by the paramedian papillae into patches outlined by dark brown, the remainder of the dorsum dark, the venter uniform light brown.

Miss Lambert's description was a major contribution to the morphology of the haemadipsine leeches. Blanchard (1917) adds nothing to this and recognises the species in material from Java. He places the genital pores at 26/27 and 29/30 in his figure, a separation of only 3 annuli, but describes their position as at the rear of 26 and of 30 in his text, and notes variation in the position of the female pore in 30. Some of his specimens were from the Upper Richmond River, Northern New South Wales. My own material from this area conforms to Lambert's account.

The type is in the National Museum of Victoria. Ingram (1957) detected differences in detail between Tasmanian and Mainland specimens. She described the cocoon as somewhat spherical, 7·0 mm. in diameter, pale yellow, an inner entire capsule with one perforation for eclosion, an outer honeycombed capsule of irregular hexagonal units. Thirteen leeches hatched over the period January 20 to March 4 at a length of 5·0 mm. The colour pattern established at 6·0 mm. and at 8·0 mm. the first blood meal was taken from a frog.

5. Philaemon grandis Ingram 1957

From Western Tasmania and elsewhere in Tasmania ; up to 36·0 mm. long by 6·0 mm. wide ; area behind and between eyes 1 to 4 broken into an irregular pavement (rather transversely regular in *pungens*) ; 80 annuli ; uni-annulate i, ii, iii, iv, xxiv, xxv, xxvi, xxvii, 2-annulate v, 3-annulate vi and vii, 4-annulate viii to xxiii inclusive ; genital pores in 27 and 31 ; testes, 10 pairs ; jaws with 50 denticles. Colour : median longitudinal brown stripe paralleled on either side by segmental bright yellow patches fusing into irregular lines in the mid-region of the body ; the rest of the dorsum with brown bands ; a lateral marginal yellow stripe ; the venter uniform light brown.

The characters indicate a distinctive species.

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(* indicates paper not seen)